

**IN THE CLAIMS:**

1. An apparatus for cleaning an irradiated nuclear fuel assembly, comprising:  
a housing; and

5 a plurality of ultrasonic transducers positioned on said housing to supply  
radially emanating omnidirectional ultrasonic energy that removes deposits from an  
irradiated nuclear fuel assembly positioned proximate to said housing.

10 2. The apparatus of claim 1 wherein said plurality of ultrasonic transducers are  
each configured to include a rod with a first end and a second end, a first piezoelectric  
transducer positioned at said first end and a second piezoelectric transducer positioned  
at said second end.

15 3. The apparatus of claim 1 wherein said plurality of ultrasonic transducers have  
an associated reflector including a first reflector surface, an air gap, and an outer  
surface.

20 4. The apparatus of claim 1 wherein said plurality of ultrasonic transducers  
include a first transducer positioned to produce a first set of radially emanating  
omnidirectional ultrasonic energy waves with minimum displacement nodes at  
selective positions, and a second transducer positioned to produce a second set of  
radially emanating omnidirectional ultrasonic energy waves with maximum  
displacement nodes at said selective positions.

25 5. The apparatus of claim 1 wherein said housing includes a first end with a guide  
to direct said nuclear fuel assembly into said housing.

30 6. The apparatus of claim 1 wherein said housing includes a second end with an  
aperture defining an emergency cooling hole.

7. The apparatus of claim 6 wherein said second end is configured to receive  
filtration piping.

8. The apparatus of claim 7 further comprising a pump connected to said filtration piping.

9. The apparatus of claim 8 further comprising a filter connected to said pump.

5

10. The apparatus of claim 1 further comprising a hoist to position said irradiated nuclear fuel assembly within said housing.

11. The apparatus of claim 10 wherein said hoist re-positions said nuclear fuel assembly at a sequence of positions along the longitudinal axis of said housing while said plurality of ultrasonic transducers are activated.

12. A method of cleaning an irradiated nuclear fuel assembly, said method comprising the steps of:

15 positioning a nuclear fuel assembly adjacent to a housing; and supplying radially emanating omnidirectional ultrasonic energy from transducers positioned on said housing to said nuclear fuel assembly to remove deposits from said nuclear fuel assembly.

20 13. The method of claim 12 wherein said supplying step includes the step of selectively reflecting said radially emanating omnidirectional ultrasonic energy within said housing.

14. The method of claim 12 further comprising the step of circulating a liquid through said housing during said supplying step.

25

15. The method of claim 14 further comprising the step of filtering said liquid.

16. The method of claim 14 further comprising the step of measuring radioactive activity within said liquid.

30

17. The method of claim 16 further comprising the step of stopping said supplying step when said radioactive activity drops to a predetermined level.

18. The method of claim 12 further comprising the step of re-positioning said 5 nuclear fuel assembly at a sequence of positions along the longitudinal axis of said housing during said supplying step.

19. The method of claim 13 wherein said supplying step includes the step of supplying radially emanating omnidirectional ultrasonic energy with a frequency 10 between approximately 20 to 30 kHz at a transducer power between 1,000 and 1,500 Watts.

20. The method of claim 12 wherein said supplying step includes the step of supplying a first set of radially emanating omnidirectional ultrasonic energy waves 15 with minimum displacement nodes at selective positions, and supplying a second set of radially emanating omnidirectional ultrasonic energy waves with maximum displacement nodes at said selective positions.

*and  
B  
add  
c  
s  
a*